ZooKeys 564: 121–156 (2016)
doi: 10.3897/zookeys.564.6819
http://zookeys.pensoft.net

RESEARCH ARTICLE

A peer-reviewed open-access journal
ZooKeys
Launched to accelerate biodiversity research

Contributions to the knowledge of subterranean trechine beetles in southern China's karsts: five new genera (Insecta, Coleoptera, Carabidae, Trechinae)

Mingyi Tian[1], Sunbin Huang[1], Xinhui Wang[1], Mingruo Tang[1]

1 *Department of Entomology, College of Agriculture, South China Agricultural University, No. 483 Wushan Road, Guangzhou, 510642, China*

Corresponding author: *Mingyi Tian* (mytian@scau.edu.cn)

Academic editor: *A. Casale* | Received 11 October 2015 | Accepted 6 January 2016 | Published 16 February 2016

http://zoobank.org/8D6563D6-7C4F-4435-BE6C-19CCE2F9882F

Citation: Tian M, Huang S, Wang X, Tang M (2016) Contributions to the knowledge of subterranean trechine beetles in southern China's karsts: five new genera (Insecta, Coleoptera, Carabidae, Trechinae). ZooKeys 564: 121–156. doi: 10.3897/zookeys.564.6819

Abstract

Recent discoveries reveal that southern China's karsts hold the most diverse and morphologically modified subterranean trechine beetles in the world, albeit the first troglobitic blind beetle was only reported in the early 1990's. In total, 110 species belonging to 43 genera of cavernicolous trechines have hitherto been recorded from the karsts of southern China, including the following five new genera proposed below: *Shiqianaphaenops* Tian, **gen. n.**, to contain two species: *Shiqianaphaenops majusculus* (Uéno, 1999) (= *Shenaphaenops majusculus* Uéno, 1999, **comb. n.**), the type species from Cave Feng Dong, Shiqian, Guizhou, and *Shiqianaphaenops cursor* (Uéno, 1999) (= *Shenaphaenops cursor* Uéno, 1999, **comb. n.**), from Cave Shenxian Dong, Shiqian, Guizhou; and the monotypic *Dianotrechus* Tian, **gen. n.** (the type species: *D. gueorguievi* Tian, **sp. n.**, from Cave Dashi Dong, Kunming, Yunnan), *Tianeotrechus* Tian & Tang, **gen. n.** (the type species: *T. trisetosus* Tian & Tang, **sp. n.**, from Cave Bahao Dong, Tian'e County, Guangxi), *Huoyanodytes* Tian & Huang, **gen. n.** (the type species: *H. tujiaphilus* Tian & Huang, **sp. n.**, from Longshan, Hunan) and *Wanhuaphaenops* Tian & Wang, **gen. n.** (the type species: *W. zhangi* Tian & Wang, **sp. n.**, from Cave Songjia Dong, Chenzhou, Hunan).

Keywords

New genus, new species, new combination, cavernicolous, ground beetle, Guizhou, Yunnan, Guangxi, Hunan

Copyright *Mingyi Tian et al.* This is an open access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Introduction

China is long known to support with the largest karst landscapes and ecosystems in the world (Waltham 2009). Like in many other fields of natural sciences, however, modern speleological activities in China started much later than in other countries of Europe, North America or Japan, although the well-known Ming Dynasty traveler Xu Xiake made important contributions to cave surveys already during the first half of the 17th century. While in many countries caves are described and registered (e.g. more than 34,000 caves in Italy, see Stoch 2002), there is still no available cave database in China, where only rather few caves are well explored and surveyed. The situation is the same for cave biology. In China, cave-dwelling animals have been continuously reported since the 1980's, mostly by foreign researchers, but there is still a long way to go. With the exception of several vertebrates such as fishes, bats and frogs, almost nothing is known about troglobitic invertebrates presented in the Red Data book of China or on the list of endangered species which are strictly protected by law in China (Wang and Xie 2005).

However, this situation is changing. Discoveries during last two decades reveal that the karsts of southern China host the globe's most diverse fauna of subterranean trechine beetles, including that at the generic level. Up to date, 38 genera and 106 species of cave trechines have been recorded from southern China. Below is a checklist of cavernicolous trechine genera known from southern China's karsts, coupled with data on their species diversity and geographical ranges.

Agonotrechus Jeannel, 1923: only a single troglophilous species recorded from a cave in western Hubei (Deuve 1999);

Aspidaphaenops Uéno, 2006: three species, all troglobitic and all known from Qianxinan, Guizhou (Uéno 2006b);

Bathytrechus Uéno, 2005: one species, troglobitic, in Leye, northwestern Guangxi (Uéno 2005a);

Boreaphaenops Uéno, 2002: a single species, troglobitic, in Shennongjia, western Hubei (Uéno 2002, 2010);

Cathaiaphaenops Deuve, 1996: six species, troglobitic, known from Hunan, Hubei and Chongqing (Deuve 1996, 1999, Uéno 2000b);

Cimmeritodes Deuve, 1996: two species, troglobitic, one in Longshan, northwestern Hunan, the other in Quzhou, eastern Zhejiang (Deuve 1996, Uéno 2006b, Deuve and Tian 2015);

Dongodytes Deuve, 1993: 12 species, highly modified, troglobitic, in several counties of northwestern Guangxi (Deuve 1993, Uéno 1998, 2005c, Tian 2011, Tian et al. 2014);

Giraffaphaenops Deuve, 2002: two species, extremely modified, troglobitic, in several caves in Leye and a cave in Tianlin, northwestern Guangxi respectively (Deuve 2002, Uéno 2003b, Tian and Luo 2015);

Guiaphaenops Deuve, 2002: one species, troglobitic, in Lingyun, northwestern Guangxi (Deuve 2002; Uéno 2006a);

Guizhaphaenops Vigna Taglianti, 1997: 11 species in two subgenera, troglobitic, in Guizhou and Yunnan (Vigna Taglianti 1997, Deuve 1999, 2001, Uéno 1998, 2000a, Uéno and Ran 2004, Deuve and Quéinnec 2014);

Jiangxiaphaenops Uéno & Clarke, 2007: a single species, troglobitic, known from Wannian, Jiangxi (Uéno and Clarke 2007);

Jiulongotrechus Tian, Huang & Wang, 2015: a single species, troglobitic, known from Tongren, eastern Guizhou (Tian et al. 2015);

Junaphaenops Uéno, 1997: a unique species, troglobitic, known from Kunming, the capital City of Yunnan Province (Uéno 1997);

Libotrechus Uéno, 1998: two species, troglobitic, in southernmost Guizhou and northern Guangxi (Uéno 1998, Lin and Tian 2014);

Luoxiaotrechus Tian & Yin, 2013: two species, troglobitic, from eastern Hunan (Tian and Yin 2013, Tian and Huang 2015);

Microblemus Uéno, 2007: a single species, troglobitic, in Jinhua, eastern Zhejiang (Uéno 2007);

Minimaphaenops Deuve, 1999: a single species, troglobitic, in Fengjie, Chongqing (Deuve 1999);

Oodinotrechus Uéno, 1998: Three species, troglobitic, two in southernmost Guizhou and northernmost Guangxi (Uéno 1998, Tian 2014), one in Pingle, northeastern Guangxi (Sun and Tian 2015);

Pilosaphaenops Deuve & Tian, 2008: 2-3 species, highly modified, troglobitic, in southernmost Guizhou and northernmost Guangxi (Uéno 2002, Deuve and Tian 2008, Tian 2010);

Plesioaphaenops Deuve & Tian, 2011: a single species, troglobitic, in Longlin, western Guangxi (Deuve and Tian 2011);

Qianaphaenops Uéno, 2000: six species, troglobitic, from northeastern Guizhou (Uéno 2000c, Tian and Clarke 2012, Tian et al. 2015);

Qianotrechus Uéno, 2000: five species, troglobitic, in northern Guizhou and southeastern Sichuan (Uéno 2000c, 2003a);

Satotrechus Uéno, 2006: two troglobitic species, one in southwestern Guizhou, the other in northwestern Guangxi (Uéno 2006b, Deuve and Tian 2011);

Shenaphaenops Uéno, 1999: one species, troglobitic, in northwestern Guizhou (Uéno 1999a). The other two species originally assigned to this genus (Uéno 1999b) are transferred into a new genus described below;

Shuaphaenops Uéno, 1999: one species, troglobitic, in southern Chongqing (Uéno 1999c);

Shilinotrechus Uéno, 2003: two species, troglobitic, from eastern Yunnan (Uéno 2003a, Huang and Tian 2015);

Sichuanotrechus Deuve, 2005: five species, troglobitic, in northern Sichuan (Deuve 2005, Uéno 2006a, 2008, Huang and Tian 2015);

Sidublemus Tian & Yin, 2013: one species, troglobitic, from southeastern Hunan (Tian and Yin 2013);

Sinaphaenops Uéno & Wang, 1991: nine species in three subgenera, highly modified, troglobitic, from western to southern Guizhou, and northernmost Guangxi (Uéno

and Wang 1991, Magrini et al. 1997, Uéno and Ran 1998, Uéno 2002, Deuve and Tian 2014, Tian and Huang 2015);

Sinotroglodytes Deuve, 1996: two species, troglobitic, in northwestern most Hunan (Deuve 1996, Uéno 2009);

Superbotrechus Deuve & Tian, 2009: a single species, troglobitic, in western Hubei (Deuve and Tian 2009);

Toshiaphaenops Uéno, 1999: two species, troglobitic, from northwestern Hunan and western Hubei (Uéno 1999a);

Trechiotes Jeannel, 1954: three species, troglophilous, in Guizhou and Guangxi (Deuve et al. 1999, Deuve 1995, Uéno 2007);

Uenotrechus Deuve & Tian, 1999: one species, highly modified, troglobitic, in southern Guizhou and northern Guangxi (Deuve et al. 1999, Deuve and Tian 2010);

Wulongoblemus Uéno, 2007: one species, troglobitic, in western Zhejiang (Uéno 2007);

Yanzaphaenops Uéno, 2010: a single species, highly modified, troglobitic, in Shennongjia, western Hubei (Uéno 2005b, 2010);

Yunotrechus Tian & Huang, 2014: a single troglobitic species from southernmost Yunnan (Tian and Huang 2014);

Zhijinaphaenops Uéno & Ran, 2002: five species, troglobitic, in western and central Guizhou (Uéno and Ran 2002; Deuve and Tian 2015).

Uéno (1999a) set up the genus *Shenaphaenops* based on a single female collected from a limestone cave called Shen Dong (actually, the complete name of the cave is Shendong Migong) in Shuicheng County, northwestern Guizhou Province. Later, he found two new species from caves in Shiqian County, northeastern Guizhou and described them in *Shenaphaenops*, even though he realized that both two counties lay very far from each other, and the beetles found in Shiqian showed some peculiar features, in particular, a dilated protarsomere 1 in both sexes, a character never seen in other trechines (Uéno 1999b). We visited the type localities in both counties twice in 2014 and 2015, respectively, and successfully collected a male of *Shenaphaenops humeralis* Uéno, 1999, the type species, as well as an abundant material of *S. majusculus* Uéno, 1999. The newly collected samples provided enough evidence to show that both of these species are sufficiently different in many characters of generic importance to warrant the placement of the two known species from Shiqian into a new genus, not *Shenaphaenops*.

Thanks to Dr. Borislav V. Gueorguiev (National Museum of Natural History, Sofia, Bulgaria), we received a very peculiar trechine for study and as a gift. This female specimen was collected in a limestone cave called Dashi Dong in a suburb of Kunming, the capital city of Yunnan Province in autumn 2011 during a China-Bulgaria joint cave exploration in Yunnan organized by Prof. Fan Zhang (Yunnan Institute of Geography, Yunnan University). This interesting anophthalmic beetle appears to be new both at the specific and generic levels.

Among the new findings of cave-dwelling trechines during our cave surveys in Guangxi in July and August 2015, perhaps the most interesting was an unexpected

species collected in Cave Bahao Dong, Tian'e County. It is sympatric with *Dongodytes giraffa* Uéno, 2005, an extremely troglomorphic beetle, but shows very unusual morphological characters not seen in any other cavernicolous trechines known in China, such as the right mandible being quadridentate, the pronotal lateral borders invisible from above and the elytra with three dorsal pores.

In July 2014, a single female trechine was discovered in the famous Huoyan Karst, Longshan County, northwesternmost Hunan Province. It lives there together with *Cathaiaphaenops*, *Sinotroglodytes*, *Cimmeritodes* and *Toshiaphaenops* species. However, this semi-aphaenopsian beetle is very different from the other sympatric Trechini, with several peculiar characters such as a very long and tube-like head, strongly dilated femora, very convex pronotum and elytra, and a strange elytral chaetotaxy, in which the humeral group of marginal umbilicate series is composed of five, not four, pores.

In late August 2015, we were invited to undertake a cave biodiversity survey in the Wanhuayan cave system, southern Hunan, as part of the cave exploration activities headed by Prof. Yuanhai Zhang (Institute of Karst Geology, Chinese Academy of Geological Sciences, Guilin). Several specimens of a blind trechine species were collected. This peculiar troglobitic species is probably related to *Shenaphaenops* or even the *Sinaphaenops* complex, but with many different characteristics of generic importance.

In order to properly assess the above trechine species, five new genera are established below, including the proposal of two new combinations for both Shiqian species formerly treated in *Shenaphaenops*, and the description of four new species forming four monotypic genera from limestone caves in Yunnan, Guangxi and Hunan, respectively.

Material and methods

The beetle specimens were collected by using an aspirator inside the cave, and kept in 55% ethanol before study. Dissections and observations were made under a Leica S8AP0 microscope. Dissected genital pieces, including the median lobe and parameres of the aedeagus, were glued onto small transparent plastic plates and pinned under the specimen they belonged to. Habitus pictures were taken by means of a Keyence VHX-5000 digital microscope. Genital pictures were taken using a Canon EOS 40D camera connected to a Zeiss AX10 microscope, and then stacked and processed by means of Adobe Photoshop CS5 software. Distribution maps created using Mapinfo software.

The length of the body was measured from the apex of the right mandible (in open position) to the elytral apex; the width of the body was taken as the maximum width of the elytra.

Abbreviations of other measurements used in the text are as follows:

HLm length of head including mandibles, from apex of right mandible to occipital suture;
HLl length of head excluding mandibles, from front of labrum to occipital suture;
HW maximum width of head;

PrL length of prothorax, along the median line;
PnL length of pronotum, as above;
PrW maximum width of prothorax;
PnW maximum width of pronotum;
PfW width of pronotum at front;
PbW width of pronotum at base;
EL length of elytra, from base of scutellum to elytral apex;
EW maximum width of combined elytra.

Taxonomy

***Shiqianaphaenops* Tian, gen. n.**
http://zoobank.org/D7A2BFB8-59A2-4BA4-A26C-630F9E5B7488

Type species. *Shenaphaenops majusculus* Uéno, 1999 (Cave Feng Dong, Shiqian, Guizhou).

Diagnosis. Medium-sized aphaenopsian trechine beetles, with sparsely pubescent body, elongated head, reduced frontal furrows, tridentate right mandible, 4-setose mentum, tumid propleura, widened 1st protarsomere and bisetose on each of abdominal ventrites.

Generic characteristics. Medium-sized aphaenopsian trechines, yet not too highly modified morphologically; eyeless, unpigmented and apterous; body slender and elongate, with slender and long appendages; covered with sparse pubescence, hairs being much longer on head and pronotum than on elytra; head elongate, longer than prothorax, much longer than wide; frontal furrows short, with two pairs of supraorbital pores; right mandible tridentate; labial suture clear; mentum 4-setose, tooth simple and short, blunt at apex; submentum 9-setose; antennae long, nearly extending to elytral apex; prothorax longer than wide, propleura visible from above; pronotum elongate, longer than wide, widest near front; only anterior pairs of lateromarginal setae; elytra elongate-ovate, strongly convex, shoulders distinct and rounded, lateral margins ciliated throughout; striae faintly impressed; two dorsal and the pre-apical pores present on each elytron; humeral group of marginal umbilicate pores not aggregated; protibia without longitudinal groove externally; 1st protarsomere in both sexes widened and angularly produced externally, with a row of comb-like setae on ventral side; 1st and 2nd protarsomeres modified in male; ventrite VII with two pairs of setae in both sexes.

Remarks. Uéno (1999) hesitantly treated the two trechine species found in Shiqian County, eastern Guizhou as members of the genus *Shenaphaenops* Uéno, 1999, which had been set up based on a single female collected in Shuicheng County, northwestern Guizhou. However, he realized some striking differences and the geographical gap between the Shiqian species and the type species *S. humeralis* Uéno, 1999. Apart from the somewhat similar general body configurations in both *Shiqianaphaenops* gen. n. (Fig. 1) and *Shenaphaenops* (Fig. 2), many character states of generic importance are

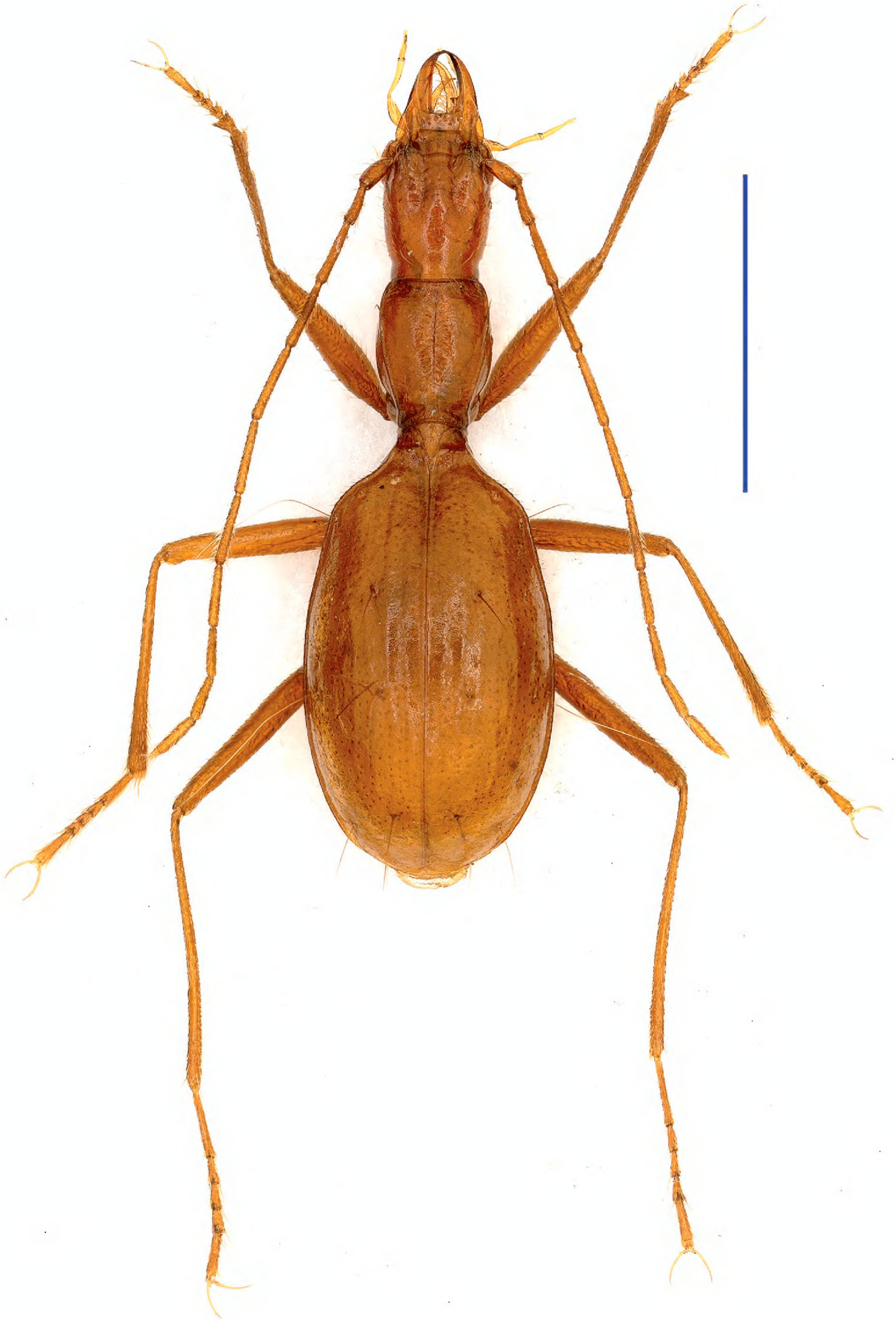

Figure 1. Habitus of *Shiqianaphaenops majusculus* (Uéno, 1999), comb. n., male Scale bar: 2.0 mm.

Figure 2. Habitus of *Shenaphaenops humeralis* Uéno, 1999, male Scale bar: 2.0 mm.

different, such as: (1) 1st protarsomere in both sexes widened apically and distinctly produced externally, covered with a ctenidium structure ventrally in *Shiqianaphaenops* which, amongst trechines, is only found in this genus; (2) right mandible tridentate in *Shiqianaphaenops*, versus bidentate in *Shenaphaenops*; (3) labial suture clear in *Shiqianaphaenops*, but completely missing in *Shenaphaenops*; (4) ventrite VII in male bisetose in *Shiqianaphaenops*, versus 4-setose in *Shenaphaenops*; (5) in male, both 1st and 2nd protarsomeres modified in *Shiqianaphaenops*, versus only 1st protarsomere being modified in *Shenaphaenops*; (6) pubescence weaker and sparser, hairs much longer on head and pronotum than on elytra in *Shiqianaphaenops*, versus generally denser and hairs being of same length in *Shenaphaenops*; (7) base of pronotum much narrower than front in *Shiqianaphaenops*, versus only slightly narrower in *Shenaphaenops*; (8) elytra broader, with humeral angles rounded in *Shiqianaphaenops* (Fig. 3A), versus more slender, with humeral angles distinctly angular in *Shenaphaenops* (Fig. 3B); (9) marginal sides of elytra ciliate throughout, versus smooth in *Shenaphaenops*; (10) in *Shiqianaphaenops*, median lobe of aedeagus stout and thick, broadly rounded dorsally, basal part comparatively small, with an indistinct sagittal aileron, inner sac armed with a very large copulatory piece; apical lobe contracted at apex, roundly blunt in lateral view, but pointed in dorsal view; parameres thin, much shorter than median lobe, each bearing three long setae at apex (Fig. 4A, B). In contrast, median lobe of aedeagus in *Shenaphaenops* slender and thin, gently expanded dorsally, basal part comparatively large, with a small but distinct sagittal aileron; apical lobe indistinctly contracted at apex, obtuse in lateral view, broad in dorsal view; inner sac armed with a large copulatory piece; parameres shorter than median lobe, left one slightly longer than right one, each bearing two long setae at apex (Fig. 4C, D).

Etymology. Shiqian+Aphaenops, to indicate that both known members of this genus occur in Shiqian County, eastern Guizhou Province. Gender masculine.

Range. China (eastern Guizhou) (Fig. 5c).

Known so far by two very similar species from two caves in Shiqian County: Shenxian Dong and Feng Dong. Since Shenxian Dong lies very close to Feng Dong, only about one kilometre in distance across a shallow valley, with still another cave just between them, all three caves may prove belong to a same cave system. Perhaps this is why both Uéno's species from Shiqian County are not too different from each other. Feng Dong is a large and beautiful cave (Fig. 6A, B). The beetle (Fig. 6C) is sympatric with millipedes, crickets and frogs.

Material examined. *Shenaphaenops humeralis* Uéno, 1999: a male, Cave Shendong Migong (Shendong in the original description), Muqiao, Laoyingshan, Shuicheng County, northwestern Guizhou, 26°35'15"N/ 104°59'47"E, 1910 m in altitude, VIII-22-2014, Mingyi Tian leg., deposited in the insect collections of South China Agricultural University (SCAU).

Shiqianaphaenops majusculus (Uéno, 1999), comb. n.: 3 males, V-1-2015, Cave Feng Dong, Tangshan, Shiqian County, 27°29'10"N/108°15'23"E, 700 m in altitude, Mingyi Tian & Jingli Cheng leg., in SCAU; 6 males & 4 females, ibid., VIII-1-2015, same collectors, in SCAU.

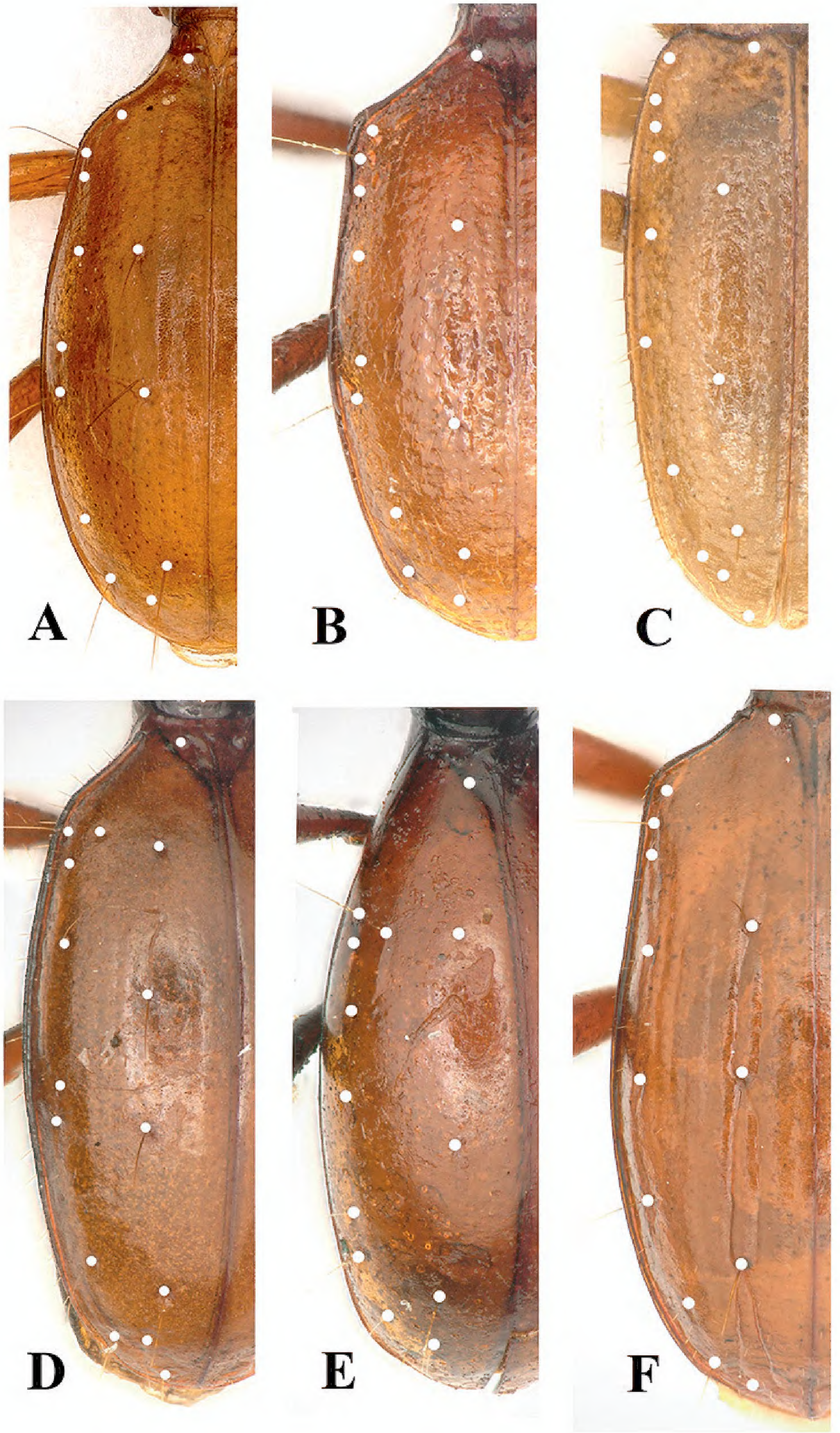

Figure 3. Elytral chaetotaxy **A** *Shiqianaphaenops majusculus* (Uéno, 1999), comb. n. **B** *Shenaphaenops humeralis* Uéno, 1999 **C** *Dianotrechus gueorguievi* Tian, gen. n., sp. n. **D** *Tianeotrechus trisetosus* Tian & Tang, gen. n., sp. n. **E** *Huoyanodytes tujiaphilus* Tian & Huang, gen. n., n. sp. **F** *Huoyanodytes tujiaphilus* Tian & Huang, gen. n., sp. n. **G** *Wanhuaphaenops zhangi* Tian & Wang, sp. n.

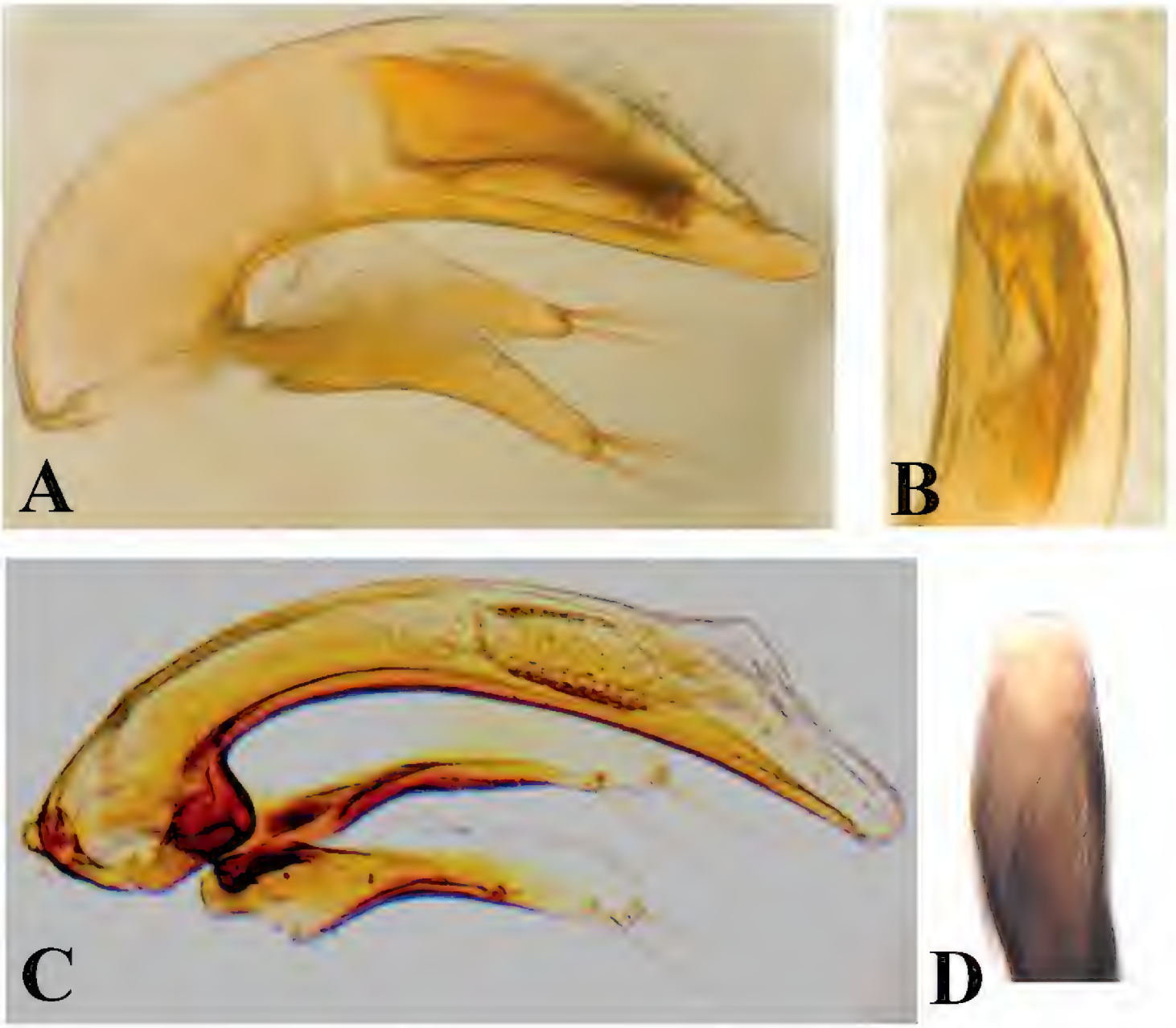

Figure 4. Male genitalia **A** and **C** median lobe, lateral view **B** and **D** apical lobe, dorsal view **A** and **B** *Shiqianaphaenops majusculus* (Uéno, 1999), comb. n. **C** and **D** *Shenaphaenops humeralis* Uéno, 1999.

Shiqianaphaenops cursor (Uéno, 1999), comb. n.: We have not seen any material. We visited Cave Shenxian Dong, the type locality, in August 2015, but failed to catch anything. The cave is badly disturbed by human activities.

Dianotrechus Tian, gen. n.

http://zoobank.org/844915FD-7B9B-421B-8143-0ACA207CEF54

Type species. *Dianotrechus gueorguievi* Tian, sp. n. (Cave Dashi Dong, Kunming, Yunnan).

Diagnosis. Small-sized and anophthalmic trechine beetles, with robust head, complete frontal furrows, bidentate right mandible, 4-setose mentum, fused mentum and submentum, short appendages, quadrate pronotum, widely spaced middle pores of the marginal umbilicate setiferious series and 6-setose ventrite VII in female.

Generic characteristics. Small-sized, anophthalmic trechine; unpigmented and apterous; head robust, genae strongly convex laterally; frontal furrows entire, two

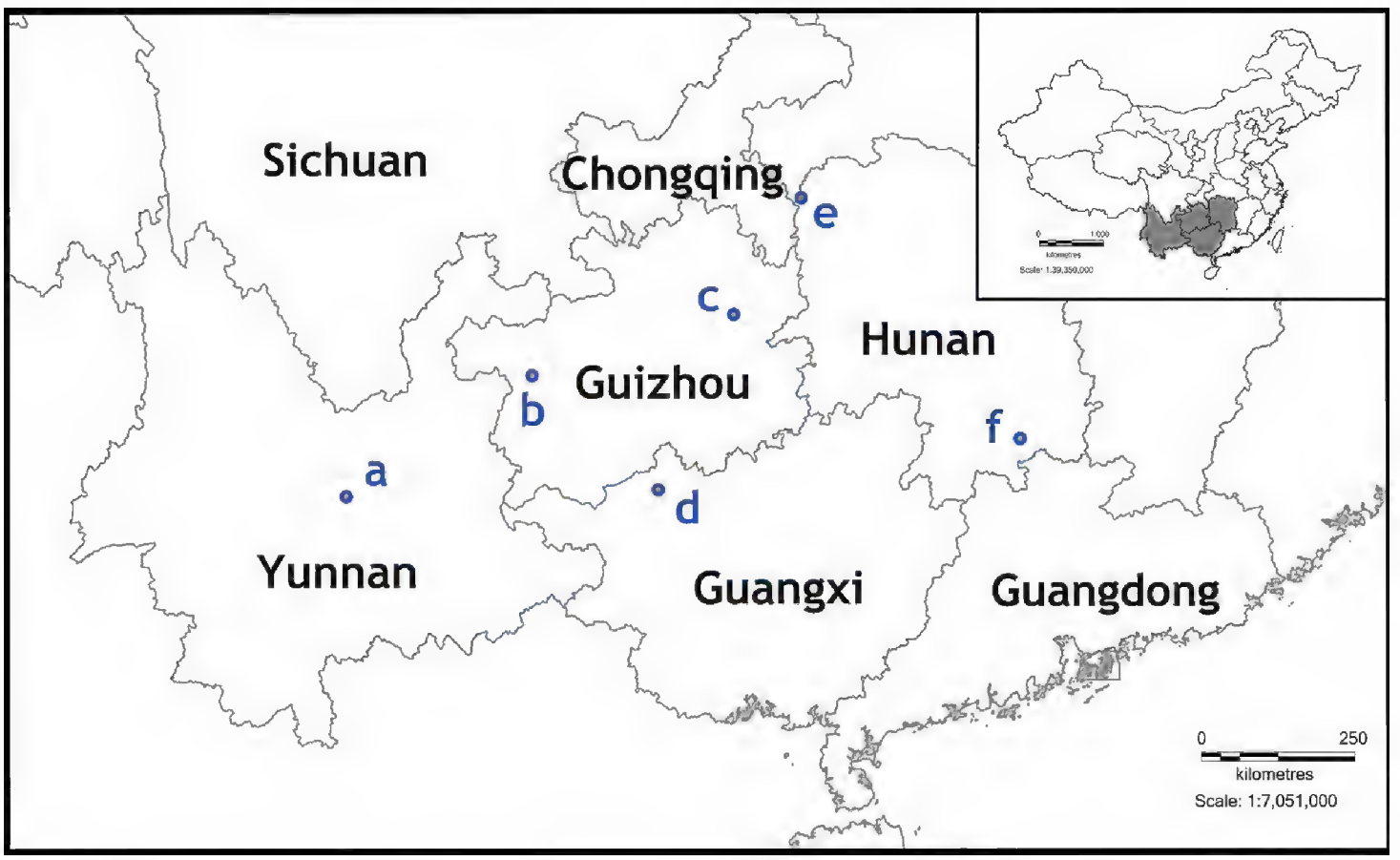

Figure 5. Distribution of the trechine beetles **a** *Dianotrechus gueorguievi* Tian, gen. n., sp. n. **b** *Shenaphaenops humeralis* Uéno, 1999 **c** *Shiqianaphaenops majusculus* (Uéno, 1999), comb. n. **d** *Tianeotrechus trisetosus* Tian & Tang, gen. n., sp. n. **e** *Huoyanodytes tujiaphilus* Tian & Huang, sp. n. **f** *Wanhuaphaenops zhangi* Tian & Wang, gen. n., sp. n.

pairs of supra-orbital pores; right mandible bidentate; mentum and submentum completely fused; submentum 7-setose, a shorter seta present in the middle; mentum 4-setose; antennae short and stout, extending to basal third of elytra; prothorax with propleura invisible from above; pronotum quadrate, two pairs of laterodorsal setae present; elytra elongate-ovate, moderately convex, without prehumeral angles, lateral margins gently expanded, ciliated throughout; punctate-striate, two dorsal and the pre-apical pores present, apical stria present, humeral group of marginal umbilicate pores not aggregated, 5th and 6th pores of middle group widely separated, 5th pore strikingly shifted forward, much closer to 4th than to 6th; scutellum small; legs short and stout; protibia without longitudinal groove externally; ventrite VII in female with three pairs of setae.

Remarks. The most striking peculiarities of this new genus lie in the conformation of the pronotum and the chaetotaxal pattern on the elytra, especially the middle group of umbilicate pores, in which the 5th pore is much closer to the 4th than to the 6th. *Dianotrechus* gen. n. seems to be particularly close to *Shilinotrechus* Uéno, 2003, an anophthalmic trechine genus also recorded from eastern Yunnan, but the former genus differs from the latter by the following character states: small-sized (versus medium-sized in *Shilinotrechus*); right mandible bidentate (versus tridentate in *Shilinotrechus*); body shape nearly parallel-sided (versus fusiform in *Shilinotrechus*); head of anophthalmic type (versus aphaenopsian type in *Shilinotrechus*); ventrite VII with three pairs

Figure 6. Cave Feng Dong, type locality of *Shiqianaphaenops majusculus* (Uéno, 1999), comb. n. **A** entrance **B** cave chamber, to show where the beetles were collected **C** a wandering individual in cave.

of setae in female (versus two pairs in *Shilinotrechus*). Some more differences are also evident in the conformation of the pronotum and elytra, as well as the chaetotaxy pattern of the marginal umbilicate series.

Compared to *Cimmeritodes* Deuve, 1996, a small-sized trechine genus originally reported from the Huoyan Karst of Longshan County, northwestern Hunan Province, but also occurring in Zhejiang (Deuve and Tian 2015), *Dianotrechus* gen. n. is easily distinguished by the bidentate right mandible (versus tridentate in *Cimmeritodes*), the quadrate pronotum (versus cordate in *Cimmeritodes*), the chaetotaxy pattern of the marginal umbilicate series, in which the 5th is more distant from the 6th than from the

4th (reverse in *Cimmeritodes*), and ventrite VII has three pairs of setae in the female (two pairs in *Cimmeritodes*).

Etymology. Dian + Trechus, "Dian" is a short name for Yunnan Province in Chinese. The name of the new genus reflects the occurrence of this cavernicolous trechine in Yunnan. Gender masculine.

Range. China (eastern Yunnan) (Fig. 5a).

Dianotrechus gueorguievi Tian, sp. n.

http://zoobank.org/1618C05C-2922-4288-94C0-AF26A23054B2

Holotype. Female, labeled "China, Yunnan Province, Ermu Vill., Kunming District, Dashi Dong (Big Rock Cave), 24°49'13"N/102°27'56"E, 1940 m in altitude, XI-8-2011, B. Petrov leg.", in SCAU.

Diagnosis. A small, stout, yellowish brown beetle which is densely pubescent, with short fore body and appendages, convex head, not tumid propleura which invisible from above, rather flat elytra and coarsely punctate elytral striae.

Description. Length: 3.1 mm (including mandibles), width: 0.9 mm. Habitus as in Fig. 7

Whole body yellowish brown, with palps pale; head and pronotum shiny, elytra dim; frons and vertex glabrous, genae with several short hairs, pronotum with a few fine setae, whole elytra covered with erect setae, these being as long as those on genae; underside generally glabrous, smooth and polished, but a few short hairs present on ventrites II and IV, and in lateral areas of prosternum; microsculptural meshes vanishing on head and pronotum, densely and moderately engraved on elytra. Fore part of body much shorter than elytra, EL/(HLm+PnL) = 1.39.

Head short and stout, much longer than wide (including mandibles), HLm/HW = 1.44, or as long as wide (excluding mandibles), genae broadly convex, frons and vertex moderately convex, frontal furrows entire, strongly divergent backwards; both supra-orbital pores closely located, posterior ones almost on frontal furrows, distance between anterior and posterior pores shorter than that between supra-orbital furrows at the closest point, neck short and broad; clypeus 4-setose, labrum transverse, nearly straight at frontal margin, 6-setose; mandibles rather short; labial suture missing; mentum 4-setose (two laterally and two at base of mental tooth); mentum tooth simple, very short, broad at apex; basal emargination wide and rather deep; ligula small and short, adnated to paraglossae, widened at apex, 6-setose; palps stout and short, penultimate joints much stouter than apical ones; 3rd maxillary palpomere slightly longer than 4th, labial palpomere 2nd distinctly longer than 3rd, bisetose at inner margin, with two additional setae in outer apical parts; 3rd maxillary palpomere with two tiny setae near apex; suborbital pores present, located in median portion of ventral genae, lying far from base of head; antennae short and stout, wholly pubescent, 1st antennomere stouter than others, 1st, 2nd and 4th-10th subequal in length, 3rd slightly longer than 2nd, but slightly shorter than 11th.

Figure 7. Habitus of *Dianotrechus gueorguievi* Tian, gen. n., sp. n., holotype, female Scale bar: 2.0 mm.

Prothorax: propleura not tumid, invisible from above; pronotum transverse, PnL/PnW = 0.84, wider than head, PnW/HW = 1.27, much shorter than head (including mandibles), HLm/PnL = 1.44, or as long as head (excluding mandibles); disc moderately convex; widest at about middle where lateral sides slightly expanded but remaining nearly parallel-sided, reflexed near hind angles; fore lateromarginal seta located at a little before middle, basal one a little before hind angle; fore angles rounded, basal ones rectangular and pointed; base as wide as front; front almost straight, base nearly straight medially, obtusely sinuate near hind angles; median line fine and well-defined, reaching front margin, but ending before basal transverse impression, the latter being distinctly marked and connected to basal foveae; front transverse impression unclear. Scutellum small and short.

Elytra elongate, slender, moderately convex, wider than pronotum, almost twice as long as wide, EL/EW =1.93, widest at about middle of elytra, gently narrowed towards

Figure 8. Cave Dashi Dong, type locality of *Dianotrechus gueorguievi* Tian, gen. n., sp. n. **A** entrance, outside view **B** entrance, inside view **C** main passage.

base and subapex; base wide, shoulders rounded, prehumeral angles missing; apex of each elytron rounded; disc moderately convex, striae coarsely punctate, intervals slightly convex; 1st-4th striae and apical striae well-marked, 1st-3rd striae complete, 4th finished at level before median dorsal pore; other striae wanting; basal pore present, lying near basal margin and on side of scutellum; both dorsal pores located on 4th intervals, at about basal third and a little behind the middle of elytra, respectively, pre-apical pore located at apical fusion of 2nd and 3rd striae, level to ending point of apical stria, about twice as far from apex as from suture; marginal umbilicate series with 1st, 2nd, 6th and

apical pores close to marginal gutter, 2nd-4th pores equidistant, but 1st more isolated; 5th pore widely removed away from 6th and closer to 4th pore.

Legs moderately long, covered with dense and short hairs; protarsi short, 1st tarsomere not distinctly wider than others, longer than 2nd and 3rd combined, but shorter than 2nd-4th combined; meso- and metatarsi longer, 1st tarsomere as long as 2nd-4th combined, respectively. Ventrites IV-VI each with a pair of paramedian setae, ventrite VII in female with three pairs of setae.

Male: Unknown.

Etymology. In honour of Dr. Borislav V. Guéorguiev (National Museum of Natural History, Sofia, Bulgaria), an expert in Carabidae.

Distribution. China (Yunnan) (Fig. 5a). Known only from the limestone Cave Dashi Dong in a western suburb of Kunming City (Fig. 8A–C).

Dashi Dong is located more than 1 km away from Ermu Village, Xianjie Zhen, Anning, Kunming. The opening of this cave is 27 m wide and 17 m high. Its total length is 1394 m and the total depth is 39.30 m. The temperature in the dark parts is 21 °C. The unique beetle was collected in the dark area. In order to find more specimens of this interesting beetle, we visited this cave three times in July 2014, July 2015 and August 2015, but of no avail.

Tianeotrechus Tian & Tang, gen. n.

http://zoobank.org/49A4C222-27E7-4A48-8A0D-42C391FF432C

Type species. *Tianeotrechus trisetosus* Tian & Tang, sp. n. (Bahao Dong, Tian'e County, Guangxi).

Diagnosis. Medium-sized cave beetles, with typical aphaenopsian head, reduced frontal furrows, quadridentate right mandible, evident labial suture, bisetose mentum, robust pronotum, invisible propleura from above though which is tumid, and strongly covex elytra which have three pairs of dorsal setiferious pores.

Generic characteristics. Medium-sized and semi-aphaenopsian trechines, eyeless, unpigmented and apterous; head evidently aphaenopsian, with incomplete frontal furrows and a somewhat elongated head, with two pairs of supra-orbital pores; mandibles developed, right mandible quadridentate, molar and retinacular teeth more developed than premolar tooth which is bifid (Fig. 9A); mentum and submentum well separated by labial suture; mentum bisetose, distinctly concave, mental tooth short and thick, bifid apically; submentum provided with a row of seven setae, median one minute and much shorter than others; antennae fairly short, reaching a little beyond middle of elytra; pronotum robust, longer than wide, sides expanded at apical third, making lateral suture invisible from above; posterior lateromarginal setae absent; elytra strongly convex, nearly as long as fore body (including mandibles), humeral shoulders roundly angulate, lateral sides smooth; striae reduced but more or less traceable; three dorsal and the pre-apical setae present; marginal umbilicate series not aggregate, only 2nd pore close to marginal gutter; 1st pore of humeral group shifted backward and about level

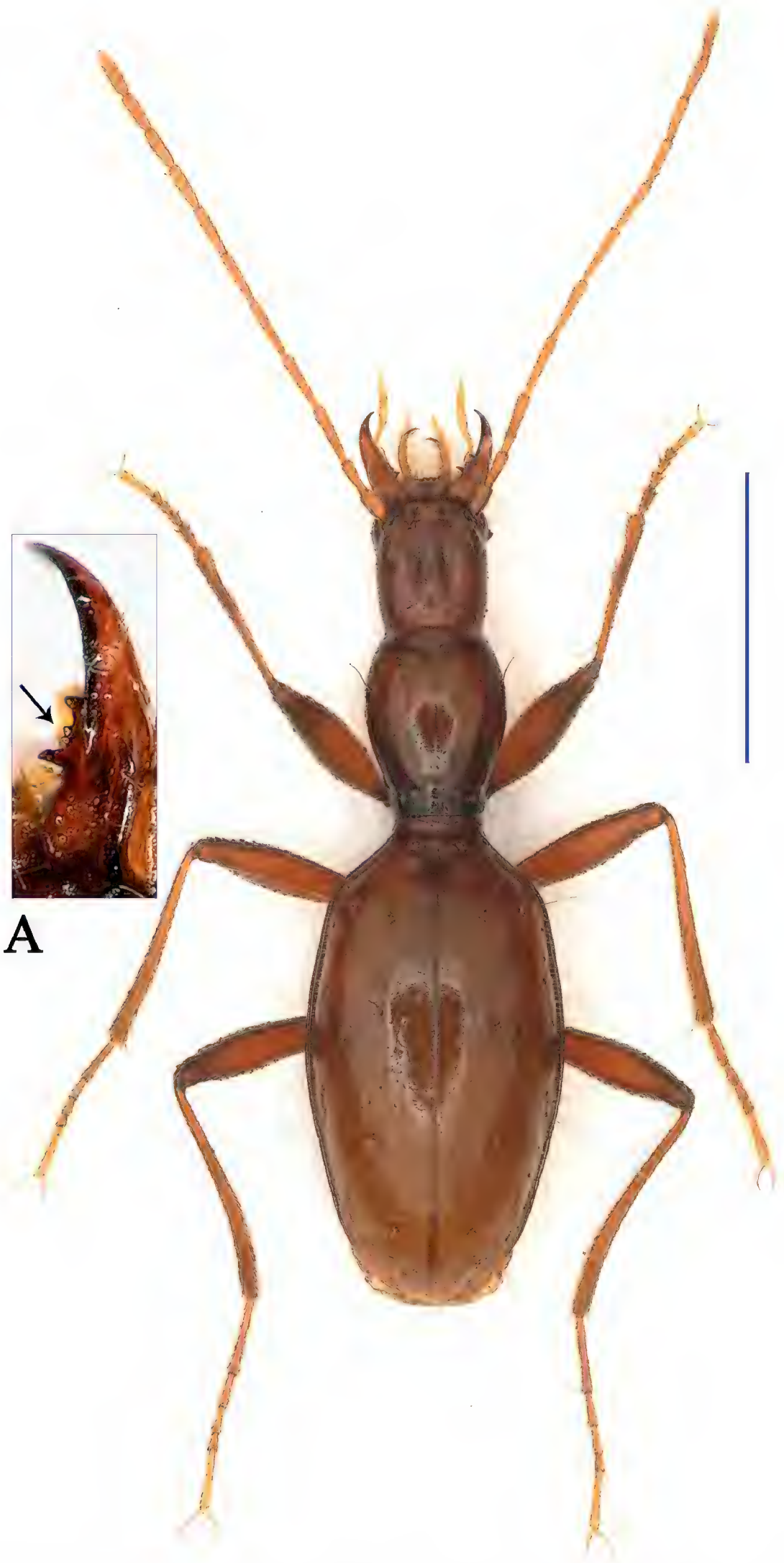

Figure 9. Habitus of *Tianeotrechus trisetosus* Tian & Tang, gen. n., sp. n., holotype, male Scale bar: 2.0 mm, **A** enlarged right mandible to show the quadrisetose teeth

to 5th stria, a little behind 2nd; 4th distant from 3rd; both pores of middle group lying close to each other; legs moderate for cave trechines, tibiae without longitudinal furrows externally; protarsi in male not modified; ventrite VII bisetose in male, 4-setose in female; male genitalia minute, well-sclerotized, moderately curved in middle part, apex slightly raised and pointed in lateral view; basal part quite large, sagittal aileron present; inner sac armed with a thin and scale-covered copulatory piece; parameres large but short, each bearing three long setae at apex.

Remarks. It is not easy to determine the taxonomic position of this new genus. Several generically important characters of *Tianeotrechus* gen. n. do not exist in the other genera of Chinese Trechini: a quadridentate right mandible, invisible pronotal lateral borders and the presence of three dorsal pores on each elytron. We hope more discoveries in the near future will be able to shed additional light to clarify this problem.

Etymology. Tian'e + Trechus, in reference to the provenance of the type species from Tian'e County. Gender masculine.

Range. China (northern Guangxi) (Fig. 5d).

***Tianeotrechus trisetosus* Tian & Tang, sp. n.**
http://zoobank.org/CDEDE83E-8CC2-4BAE-A706-45020D2D6265

Holotype. Male, Cave Bahao Dong, Gandong Village, Bala Xiang, Tian'e County, northern Guangxi, 24°55'57.10"N/107°02'40.80"E, 686 m in altitude, VIII-7-2015, Mingruo Tang leg., in SCAU; paratypes: 4 males and 1 female, ibid., in SCAU.

Diagnosis. A medium-sized trechine, with shiny and robust body, moderated appendages, convex pronotum and elytra, and elongated elytra which have round shoulders and reduced striae.

Description. Length: 5.6–5.7 mm (mean 5.66), width: 1.6 mm. Habitus as in Fig. 9.

Body brownish red, with palps, antennae and tarsi pale; frons, vertex and underside of head, pronotum, inner part of elytra glabrous, propleura and prosternum glabrous; genae, lateral parts of elytra, meso- and metasterna, and visible ventrites clothed with short pubescence; legs densely pubescent, covered with longer setae; microsculptural engraved meshes moderately transverse on head, strongly striate on pronotum and elytra.

Head elongate, much longer than wide, HLm/HW = 1.78–1.80 (mean 1.79), HLl/HW = 1.29–1.34 (mean 1.32); frons and vertex moderately convex; frontal furrows fairly long but incomplete, nearly parallel-sided, albeit slightly divergent posteriad, ending near neck constriction; genae barely expanded laterally, both sides held almost parallel; anterior and posterior supra-orbital pores located in the middle of genae and near neck constriction, respectively, distance between anterior and posterior pores much less than that between anterior pores; clypeus 4-setose, labrum transverse, widely but shallowly emarginated at front margin, 6-setose; mandibles distinctly curved at apex; palps thin and moderately long, 3rd and 4th maxillary pal-

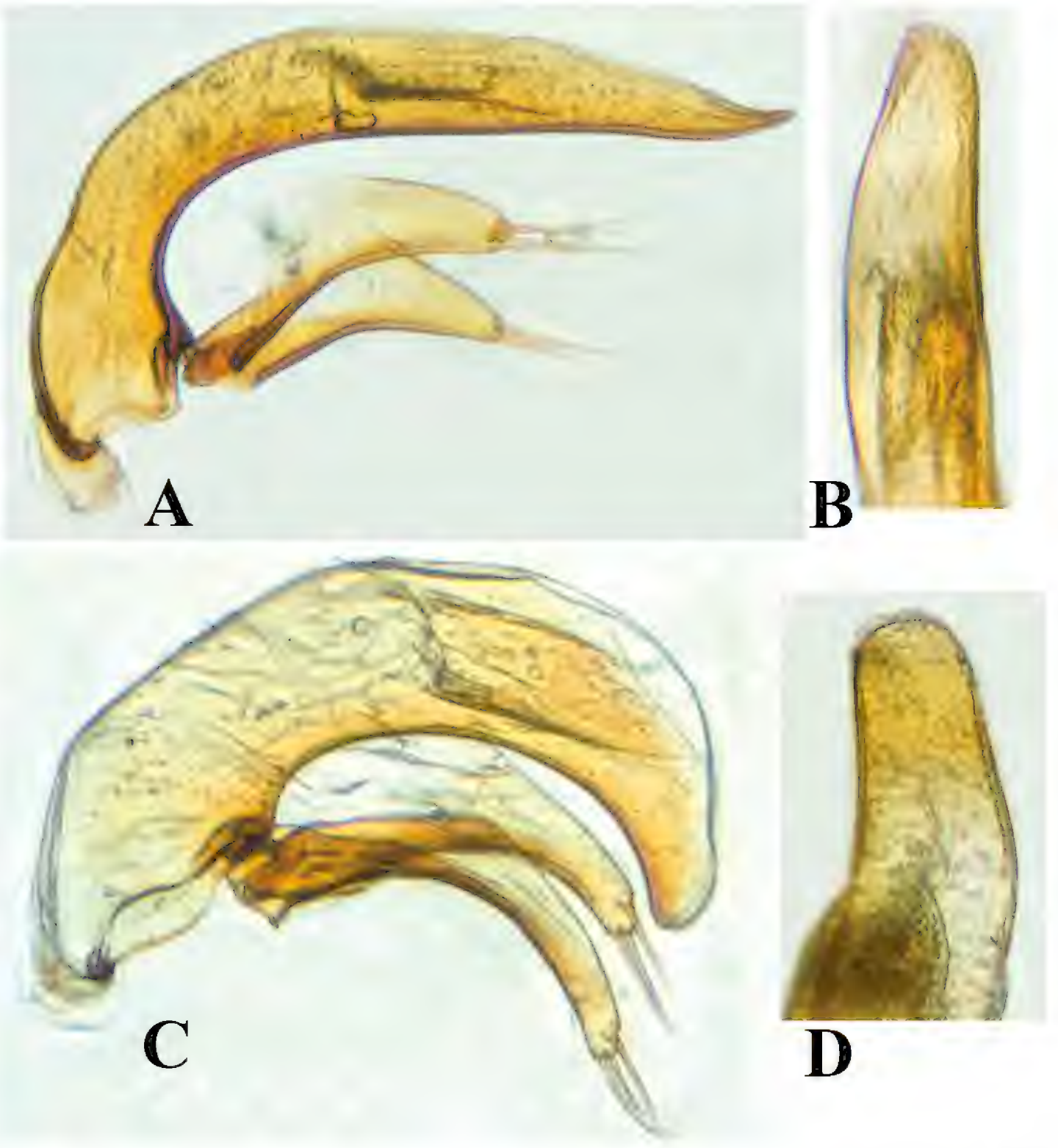

Figure 10. Male genitalia **A** and **C** median lobe, lateral view **B** and **D** apical lobe, dorsal view **A** and **B** *Tianeotrechus trisetosus* Tian & Tang, gen. n., sp. n. **C** and **D** *Wanhuaphaenops zhangi* Tian & Wang, gen. n., sp. n.

pomeres, and 3rd labial palpomere glabrous, 2nd labial palpomere 4-setose; penultimate palpomere evidently longer than apical one of labium, slightly longer in maxilla; suborbital pores on ventral side of genae, located closer to submentum than to base of head; antennae extending to about apical 3/4 of elytra, pubescent from 2nd in apical half; 1st antennomere stout and bearing several setae, slightly shorter than 2nd; 3rd 1.6 times longer than 2nd; 3rd, 4th and 5th subequal in length, then gradually shortened from 6th to 10th; 11th as long as 9th.

Prothorax expanded due to propleura, but concealed dorsally by pronotum, the latter being more strongly tumid laterally; pronotum longer than wide, PnL/PnW = 1.22-1.32 (mean 1.27); shorter than head with mandibles, PnL/HLm = 0.89-0.94 (mean 0.91); wider than head, PnW/HW = 1.24-1.32 (mean 1.28); base narrower than front, PbW/PfW = 0.885-0.894 (mean 0.889), both nearly straight and unbeaded; widest before middle, lateral margins of pronotum invisible from above; anterior lateromarginal pores present, located at about apical third; middle line fine; frontal impression faint, depressed medially, basal transverse sulcus well-marked; disc strongly convex. Scutellum small and short.

Elytra elongate ovate, much longer than wide, EL/EW = 1.72-1.75 (mean 1.74); as long as head (including mandibles) plus pronotum; much wider than pronotum, EW/PnW = 1.80-1.88 (mean 1.83); widest at about 3/7^{ths} from base; prehumeral part short, humeral angles rounded; lateral sides smooth and well-beaded, ciliated throughout; disc strongly convex except for a small area near base just behind scutellum, the latter being somewhat depressed; striae more or less obliterated but traceable, intervals slightly convex; base not bordered; basal pores on either side of scutellum, close to basal margin; three dorsal pores present on 3rd stria, located at about 1/6th, 2/5^{ths}, 2/3^{rds} and 5/6^{ths} of elytra from base, respectively; pre-apical pore lying at about 5/6^{ths} of elytra, at site of junction of 2nd, 3rd and 4th striae, much closer to elytral suture than to apical margin; humeral group of marginal umbilicate pores not aggregated, 1st, 2nd and 3rd pores forming an equilateral triangle, 4th widely distant from other three, 2nd close to, 4th far from, marginal gutter; middle group located behind middle of elytra, close to each other, distant from marginal gutter; apical pore minute, placed near elytral apex.

Legs moderately long, tibiae not longitudinally furrowed, hind tibia as long as elytral width; protarsi short; 1st tarsomere shorter than, or subequal to, or longer than 2nd-4th tarsomeres combined in pro-, meso- and metatarsi, respectively; 4th tarsomere wider than long in fore leg, as long as wide in middle leg, and evidently longer than wide in hind leg. Ventrites IV-VII each with one pair of setae.

Male genitalia (Fig. 10A, B): The median lobe of aedeagus well-sclerotized, small and slender, moderately curved ventrally in middle part, pointed at apex in lateral view; in dorsal view, apical lobe roundly broad at apex, nearly parallel-sided; base widely opening, with a large and thick sagittal aileron; parameres broad, much shorter than median lobe.

Etymology. To refer to the presence of three dorsal pores on elytron.

Distribution. China (Guangxi) (Fig. 5d). Known so far from the limestone Cave Bahao Dong, southern Tian'e County (Fig. 11A).

The cave opens below a hill, surrounded by trees and bushes and is invisible from outside. The entrance is large, but the length remains unknown. It is deep and hardly accessible, accumulated by random ripraps; it takes the cavers about an hour to reach the underground river which runs through the deepest part of the cave. All of the type series were collected under stone in twilight and transition zones, thirty to fifty meters from the entrance. It is sympatric with *Dongodytes giraffa* Uéno, 2005 (Fig. 11B, C).

Figure 11. Cave Bahao Dong, type locality of *Tianeotrechus trisetosus* Tian & Tang, gen. n., sp. n. **A** outside cave, arrowhead shows the entrance **B** a wandering individual of *Tianeotrechus trisetosus* in cave **C** a wandering individual of *Dongodytes giraffa* Uéno, 2005, in cave.

Huoyanodytes Tian & Huang, gen. n.

http://zoobank.org/1A50BCBA-6A05-4D77-8E78-3EC6C157CAC6

Type species. *Huoyanodytes tujiaphilus* Tian & Huang, sp. n. (Cave Tujiamei Dong, Longshan, Hunan)

Diagnosis. Large-sized, semi-aphaenopsian beetles, with elongated and tube-like head, long fore body, bidentate right mandible, bisetose mentum, well defined labial suture, tubiform and tumid prothorax, five pores in the humeral group of the marginal umbilicate series and disappeared elytral striae.

Generic characteristics. Large-sized, semi-aphaenopsian trechine, eyeless, unpigmented and apterous; fore body longer than elytra; head tube-like, parallel-sided, without neck constriction; much longer than wide, head (including mandible) as long as prothorax; mandible elongate, right mandible bidentate; ligula multisetose; submentum 10-setose, mentum bisetose, each of abdominal ventrites IV-VII 4-setose; labial suture clear, well separating mentum and submentum; frontal furrows short, subparallel-sided, two pairs of supra-orbital pores present; antennae long, extending to a little before elytral apex; prothorax elongate, somewhat tubiform, propleura distinctly tumid and thus visible from above; both fore and hind pronotal angles obtusely rounded; elytra ovate, strongly convex, making marginal side partly concealed and invisible from above; humeral angles rounded, widest at about middle, striae completely missing; apex broadly rounded; two dorsal and the pre-apical pores present on each elytron, humeral group of umbilicate marginal pores composed of five pores, middle group backwardly located, at about apical third of elytra; femora more dilated near subapex; tibiae long and slender, without longitudinal grooves externally.

Remarks. Again, the affinities of *Huoyanodytes* gen. n. are bound to remain obscure. Its tube-like head, the more dilated subapically femora, the very convex pronotum and elytra, and the peculiar elytral chaetotaxy are the apomorphies that make it unrelated to any other genera so far known in China. It must be pointed out that it is the first example in a trechine beetle which humeral group of umbilicate marginal pores as composed of five pores, instead of four.

Etymology. Huoyan+dytes, to refer to this genus occurring in Huoyan Karst. Gender masculine.

Range. China (northwestern Hunan) (Fig. 5e).

***Huoyanodytes tujiaphilus* Tian & Huang, sp. n.**
http://zoobank.org/C0AA3DF1-1854-4934-988E-B0A89C0E3B7C

Holotype. female, Cave Tujiamei Dong, Huoyan Karst, Huoyan Xiang, Wulongshan Geopark, Longshan County, NW Hunan Province, China, 29°12'20.11"N/109°18'37.21"E, 427 m in altitude, VII-3-2014, leg. Mingyi Tian, Weixin Liu, Haomin Yin, Sunbin Huang & Xinhui Wang, deposited in SCAU.

Diagnosis. A large cavernicolous beetle, with light dark brown fore body, light brown elytra, tubiform head and prothorax, strongly convex elytra and 4-setose on each of visible abdominal ventrites.

Description. Length: 7.0 mm including mandibles, width: 2.0 mm. Habitus as in Fig. 12.

Figure 12. Habitus of *Huoyanodytes tujiaphilus* Tian & Huang, gen. n., sp. n., holotype, female. Scale bar: 2.0 mm.

Head, pronotum legs excluding tarsi, antennomeres 1-2 light dark brown, elytra, antennomeres 3-11 light brown, palps pale; upper- and underside of head, pro-, meso- and metasterna sparsely covered with rather long setae; elytra glabrous; pronotum with two

short hairs in middle portion along mid suture; microsculptural engraved meshes moderately transverse on head, vanishing on pronotum, and strongly transverse on elytra.

Body quite large sized, rather stout, head (including mandibles) plus pronotum slightly longer than elytra, (HLm+PnL)/EL = 1.03.

Head evenly slender, much longer than wide, HLm/HW = 2.90, or HLl/HW = 2.08, genae well-developed and elongated, making head tube-like, nearly parallel-sided; frons, vertex and genae moderately convex; frontal furrows wide and deep, but short, ending at about middle of head from labrum, almost parallel to each other; anterior supra-orbital pores located at about basal 4/7th of head, lateral to frontal furrow and a little before its ending points, posterior ones located at about basal 1/5th of head excluding mandibles; distance between anterior pores as great as that between anterior and posterior pores of each side; clypeus 8-setose; labrum strongly transverse, straight at frontal margin, 6-setose; mandibles long and thin, gently incurved in apical half and distinctly unciform at apex; labial suture clear; mentum widely and deeply concave at base, bisetose, mental tooth simple, blunt at apex; submentum 10-setose; ligula 10-setose, setae being short; palps elongated, slender and subcylindrical, 3rd maxillary palpomere longer than 4th, both glabrous; 2nd labial palpomere longer than 3rd, bisetose at inner margin, and with two additional setae in subapical and apical parts, respectively; antennae long and pubescent, 1st antennomere stouter, about 2/3^{rds} as long as 2nd, which is about 3/4^{ths} as long as 3rd, 4th slightly longer than 3rd, 5th longest, slightly longer than 4th, 6th-11th as long as 4th; head (including mandibles) plus pronotum slightly longer than elytra.

Prothorax barrel-shaped, longer than wide, PrL/PrW = 1.53, widest at about third from base; longer or shorter than head excluding or including mandibles, PrL/HL = 0.76 or 1.09; much wider than head, PrW/HW = 1.45; propleura distinctly tumid, wholly visible from above; wider than pronotum, PrW/PnW = 1.17; pronotum much longer than wide, PnL/PnW = 1.79, wider than head, PnW/HW = 1.24; subparallel-sided, but narrowly and broadly contracted at both ends, making front and hind angles round off, albeit front ones fairly angulate; lateral margins not beaded; PrW/PnW = 1.17; base nearly as wide as front, frontal margin not beaded, finely emarginated in the middle, basal margin widely beaded and nearly straight; both fore and hind lateromarginal setae placed a little mesal to dorsolateral suture, at about basal fourth and apical fifth of pronotum, respectively; disc slightly convex; median line clear, reaching both ends; both transverse impressions not well-marked. Scutellum small and short.

Elytra ovate-oblong, strongly convex; twice as wide as prothorax, much longer than wide, EL/EW=1.89; widest a little behind middle, lateral margins smooth throughout, neither ciliated nor dentate; without prehumeral angles; apex broadly rounded; striae completely disappeared; two dorsal pores present on the location of 3rd stria, at about basal 2/7^{ths} and 3/5^{ths} of elytra, respectively; pre-apical pores located at about apical 2/11^{ths} of elytra; basal pore present, a little distant from scutellum; humeral group of marginal umbilicate pores not aggregated, composed of five pores, 1st pore transversally removed mesad and backward, at a little behind level to 2nd, but a little before the

anterior dorsal pore; 3rd pore close to 2nd; 3rd, 4th and 5th pores widely and equidistantly located; 6th and 7th pores of middle group shifted behind, lying at about apical fourth of elytra; apical group composed of three pores, apical pore located closer to suture than to elytral margin; only 2nd and 9th pores close to marginal gutter, others widely distant from the gutter.

Legs moderately long, femora gradually dilated from base towards subapical portions, then suddenly narrowed towards apices, covered with sparse, long and erect setae; tibiae and tarsi covered with dense and short hairs; tibiae thin, without longitudinal grooves; protarsi short, 1st tarsomere wider than others, longer than 2ndand 3rd combined, but shorter than 2nd-4th combined; meso- and metatarsi longer, 1st tarsomere as long as 2nd-4th combined.

Male: Unknown.

Etymology. tujia + philus, to refer to the fact that the new species is occurring in the country of Tujia people.

Distribution. China (Hunan)(Fig. 5e). Known only from the limestone Cave Tujiamei Dong, Wulongshan Geopark, Longshan County, northwesternmost Hunan Province.

This cave (Fig. 13A, B) lies very close to Feihu Dong, the longest cave in Huoyan Karst, along the main road, and opposite Tujiamei Restaurant. This is a water source cave, with a small underground stream running throughout, the length still being unknown. It is highly moist and muddy. We surveyed as long as about 400 m in the cave, and collected the unique specimen in the dark zone when it was wandering on the wall. The other three trechine species found in the cave are *Cathaiaphaenops delprati* Deuve, 1996 (Fig. 13C), *Sinotroglodytes bedosae* Deuve, 1996, and *Toshiaphaenops ovicollis* Uéno, 1999. We visited this and adjacent caves in July, 2015 in order to find more specimens of this interesting beetle, but failed to catch anything.

Wanhuaphaenops Tian & Wang, gen. n.

http://zoobank.org/C04A6404-CAD3-421C-97C8-5848046875BB

Type species. *Wanhuaphaenops zhangi* Tian & Wang, sp. n. (Cave Songjia Dong, Chenzhou, Hunan).

Diagnosis. Medium-sized, aphaenopsian beetles, body elongate, with short antennae and quite long legs, slender head, reduced frontal furrows, bisetose mentum, clear labial suture, short and tumid prothorax, elongated elytra and bisetose on each of abdominal ventrites.

Generic characteristics. Medium-sized, aphaenopsian type trechine, eyeless, unpigmented and apterous; body very strongly elongate, highly modified morphologically, albeit antennae rather short; head typically aphaenopsoid, extremely elongated as in *Dongodytes* Deuve, 1993 or some members of *Sinaphaenops* Uéno & Wang, 1991, much longer than wide, with short and incomplete frontal furrows ending at about middle of head from clypeus, two pairs of supra-orbital pores present, both anterior

Figure 13. Cave Tujiamei Dong, type locality of *Huoyanodytes tujiaphilus* Tian & Huang, sp. n. **A** environ outside cave, arrowhead showing the site of entrance **B** entrance **C** a wandering individual of *Cathaiaphaenops delprati* Deuve, 1996, a sympatric trechine beetle of *Huoyanodytes tujiaphilus* Tian & Huang, sp. n.

and posterior pores widely spaced; mandibles moderately long, well-developed, right mandible tridentate; labial suture clear; mentum bisetose, distinctly concave, tooth moderately long, thick and blunt at apex; submentum provided with a row of seven (or eight in a male individual) setae, median one much shorter than others; antennae quite short, extending to about middle of elytra; prothorax distinctly shorter than head, longer than wide, propleura strongly tumid, visible from above; pronotum subquadrate, base nearly as wide as front, both anterior and posterior lateromarginal setae present; elytra strongly elongate, slightly longer than head (including mandibles) plus prothorax; widest behind middle, marginal sides smooth throughout, but ciliate in humeral angle area; humera distinctly angulate; disc moderately convex, rather flat

near base, striae well-defined or obliterated, two dorsal and the pre-apical pore present; humeral pores of marginal umbilicate series not aggregated, middle group not close to each other; legs fairly long, 1st protarsomere in male modified, with a tiny apical denticle inward; tibiae without longitudinal furrow externally; ventrite VII with two pairs of setae in both sexes; aedeagus minute, well-sclerotized, short and broad, strongly arcuate, apex blunt, basal part large, with a small sagittal aileron, inner sac with a fairly large copulatory piece, parameres long, right one longer than left one, broad at apex, each bearing three long apical setae.

Remarks. The true affinities of *Wanhuaphaenops* gen. n. likewise remain uncertain. Probably the closest match is *Shenaphaenops* Uéno, 1999 (from northwestern Guizhou Province) because both share several important characters: a wholly pubescent body, humera strongly angulate, right mandibles tridentate, only 1st protarsomere modified in male, two pairs of supra-orbital pores present on head, two dorsal and the pre-apical pores present on elytron, and ventrite VII 4-setose. However, *Wanhuaphaenops* gen. n. is easily distinguished from *Shenaphaenops* by the following characters: (1) head much more elongated, with anterior supra-orbital pore widely distant from posterior one, and labial suture clear (reverse in *Shenaphaenops*); (2) antennae much shorter than in *Shenaphaenops*, in which these extending to nearly elytral apex; (3) pronotal posterior lateromarginal setae present in *Wanhuaphaenops* gen. n., but absent in *Shenaphaenops*; (4) aedeagus stouter and strongly arcuate in *Wanhuaphaenops* gen. n., with each paramere bearing three apical setae(Fig. 10C, D), versus aedeagus being slender and slightly arcuate, with each paramere bearing two apical setae in *Shenaphaenops* (Fig. 4C, D).

Wanhuaphaenops gen. n. might also be found related to the genus *Sinaphaenops* Uéno & Wang, 1991, one of the most highly modified genera among the Chinese cave-dwelling trechines which ranges from west, southern Guizhou and northernmost Guangxi. Both share a somewhat similar body configuration, but *Wanhuaphaenops* gen. n. is much smaller and less troglomorphic than *Sinaphaenops*, the appendages being much shorter, and only one joint of protarsi (1st protarsomere) is modified in the male, versus two, and a different elytral chaetotaxy.

Etymology. As Cave Songjia Dong represents one branch of the Wanhuayan cave system, the name of this new genus refers to the occurrence of this aphaenopsian beetle in Wanhuayan caves. Gender masculine.

Range. China (southern Hunan) (Fig. 5f).

Wanhuaphaenops zhangi Tian & Wang, sp. n.

http://zoobank.org/C164C788-0F9A-439E-A31A-B774DC7BB2DD

Holotype. male, Cave Songjia Dong, Beihu Qu, Chenzhou, southern Hunan Province, 25°40'08.05"N/112°53'59"E, 493 m in altitude, VIII-25-2015, Xinhui Wang, Sunbin Huang, Mingruo Tang & Pingjing Yang leg., in SCAU; paratypes: 9 females & 9 males, ibid., in SCAU.

Diagnosis. A slender and brown cave beetle, with a collar-like neck constriction on head, fairly long fore body which is slightly shorter than elytra, long head which is distinctly longer than prothorax, and distinct humeral angles of elytra.

Description. Length: 5.4–5.8 mm (mean 5.6); width: 1.4–1.6 mm (mean 1.5). Habitus as in Fig. 14.

Body wholly brown, upper surface covered with sparse and minute pubescence, genae and underside of head with some longer setae, abdominal ventrites covered with denser minute pubescence, prosternum, propleura and meso- and metasterna glabrous; legs densely pubescent; microsculpture composed of finely, densely and strongly transverse meshes on upper and underside surfaces. Body elongated, fore body, including mandibles slightly shorter than elytra.

Head strongly elongated, HLm/HW = 2.37–2.5 (mean 2.44), HLl/HW = 1.89–1.94 (mean 1.91), widest at about third of head from labrum, then gently narrowed towards a collar-like constriction of the neck; anterior supra-orbital pore level to the widest point, posterior one at about 1/5th of head from base, strongly behind end of frontal furrows; distance between anterior and posterior pores greater than that between both anterior pores; frontal furrows fine but well-defined, short, nearly parallel-sided in the middle, divergent posteriad, but then convergent before ending points; anterior supra-orbital pores located at the level of mid frontal furrows, posterior ones near collar-like constriction, distance between both posterior pores about half as that between anterior and posterior pores of either side; frons and vertex moderately convex; clypeus quadrate, 4-setose; labrum transverse, widely but shallowly emarginated at front margin; mandibles gently unciform at apex; palps fairly slender, 3rd and 4th maxillary palps glabrous, subequal in length; 2nd labial palp distinctly longer than 3rd, with two setae at inner margin, and 2–3 additional ones in subapical part, 3rd glabrous; suborbital pores on ventral side, near a collar-shaped beaded neck; 1st antennomere thick, as long as 2nd; 3rd antennomere longest, 2.5 times as long as 1st; 4th–7th and 11th slightly longer than 8th–10th.

Prothorax shorter than head, PrL/HLm = 0.60–0.67 (mean 0.63), PrL/HLl = 0.75–0.86 (mean 0.80); but much wider, PrW/HW = 1.11–1.17 (mean 1.14), longer than wide, PrL/PrW = 1.29–1.43 (mean 1.34), widest at about 3/7^{ths} from base; pronotum much longer than wide, PnL/PnW = 1.35–1.58 (mean 1.45), slightly wider than head, PnW/HW = 1.05–1.06 (mean 1.05); widest behind middle, sides beaded, gently narrowed both distad and basad, distinctly sinuate before hind angles, both front and hind angles obtuse, albeit hind ones more angulate and distinctly reflexed; anterior lateromarginal setae at about apical 2/5^{ths}, posterior ones close but a little before hind angles, distinctly shorter than the formers; base slightly wider than front, PbW/PfW = 1.05–1.07 (mean 1.06), both nearly straight, front thickly and widely bordered, base unbordered; disc convex; middle line deep, connected to both front and basal impressions. Scutellum short and small.

Elytra fairly long and elongate ovate, much longer than wide, EL/EW = 1.78–1.82 (mean 1.80), slightly longer than fore body; widest at about 4/9th from apex, lateral margins finely beaded from base to finish just before apex, finely ciliate throughout,

Figure 14. Habitus of *Wanhuaphaenops zhangi* Tian & Wang, gen. n., sp. n., holotype, male. Scale bar: 2.0 mm.

Figure 15. Cave Songjia Dong, type locality of *Wanhuaphaenops zhangi* Tian & Wang, gen. n., sp. n. **A** entrance **B** a wandering individual of *Wanhuaphaenops zhangi* **C** a platynine *Colpodes* beetle in the cave.

but remarkably distinct in angular area, nearly straight before and behind humeral angles; base not bordered; disc convex, but basal or humeral area distinctly depressed and almost flat; 2nd and 3rd striae well-marked and complete, others more or less oblit-

erated; all dorsal and pre-apical setiferous pores located exactly on interrupted and junction points of 2nd and 3rd striae, making 3rd interval with three regular longitudinal meshes between the pores; basal pores located near base, along both sides of scutellum; anterior and posterior dorsal pores at about basal third and middle of elytra, respectively, pre-apical pore at apical fourth of elytra, much closer to suture than to apex of elytra; humeral set of marginal umbilicate pores not aggregated, 1st-3rd pores equidistantly located, quite near the marginal gutter, 4th distant from 3rd; 5th and 6th isolated from each other, though 5th closer 6th than to 4th.

Legs thin and fairly long, femora moderate, tibiae not longitudinally furrowed, hind tibia slightly longer than elytral wide; protarsi short; 1st tarsomere shorter than, or subequal to, or longer than 2nd-4th tarsomeres combined in pro-, meso- and metatarsi, respectively.

Male genitalia (Fig. 10C, D): The median lobe of aedeagus very small, but well-sclerotized, with a small but distinct sagittal aileron and a fairly large copulatory piece; parameres well-developed.

Etymology. This species is named in honour of Prof. Yuanhai Zhang (Institute of Karst Geology, Chinese Academy of Geological Sciences, Guilin), who was leading the cave exploration project at Wanhuayan in late August 2015, one of the results being the discovery of this interesting species.

Distribution. China (Hunan) (Fig. 5f). Known only from the limestone Cave Songjia Dong, in the Wanhuayan cave system.

Songjia Dong is the upper part of the Wanhuayan cave system, about 10 km away from the main entrance of the Cave Wanhuayan. It is a water cave, with the entrance being as big as that in Wanhuayan (Fig. 15A). The beetles were collected in a dark area about 80 m deep from the entrance (Fig. 15B). A *Colpodes* species, a trogloxene, was also found in this cave (Fig. 15C).

Acknowledgements

First of all, we are so grateful to Prof. Yuanhai Zhang (Institute of Karst Geology, Chinese Academy of Geological Sciences, Guilin) and Mr. Geping Wen (Wanhuayan Scenic Administration, Chenzhou) for their support and assistance during the cave biological survey in Wanhuayan cave system. The first author would like to thank Dr. Borislav V. Guéorguiev (National Museum of Natural History, Sofia, Bulgaria) for sending the highly interesting trechine beetle collected in Dashi Dong, and Prof. Fan Zhang (Yunnan Institute of Geology, Yunnan University, Kunming) for providing information on Dashi Dong. Our appreciations are also extended to Weixin Liu, Wei Lin and Haomin Yin, members of the SCAU team, for their multifarious help. Particular thanks go to Prof. Dr. Sergei I. Golovatch (Institute for Problems of Ecology and Evolution, Russian Academy of Sciences, Moscow) and Dr. Thierry Deuve (the National Museum of Natural History, Paris) for their encouragement, corrections and

suggestions which helped us improve the manuscript. This study was sponsored by the Specialized Research Fund for the Doctoral Program of Higher Education of China (Grant no. 20134404110026) and National Natural Science Foundation of China (Grant no. 41271602).

References

Deuve T (1993) Description de *Dongodytes fowleri* n. gen., n. sp., Coléoptère troglobie des karsts du Guangxi, Chine (Adephaga, Trechidae). Bulletin de la Société entomologique de France 98: 291–296.

Deuve T (1995) Contribution à l'inventaire des Trechidae Trechinae de Chine et de Thaïlande (Coleoptera). Revue française d'Entomologie (N.S.) 17: 5–18.

Deuve T (1996) Descriptions de trois Trechinae anophtalmes cavernicoles dans un karst du Hunan, Chine (Coleoptera, Trechidae). Revue française d'Entomologie (N.S.) 18: 41–48.

Deuve T (1999) Nouveaux Trechidae cavernicoles chinois, découverts dans les confins karstiques du Sichuan, du Hubei et du Yunnan (Coleoptera, Adephaga). Revue française d'Entomologie (N.S.) 21: 151–161.

Deuve T (2001) Deux nouveaux *Semiaphaenops* de Chine, cavernicoles dans un karst du nord-est Yunnan (Coleoptera, Trechidae). Nouvelle Revue d'Entomologie (N.S.) 18: 187–192.

Deuve T (2002) Deux remarquables Trechinae anophthalmes des cavités souterraines du Guangxi nord-occidental, Chine (Coleoptera, Trechidae). Bulletin de la Société entomologique de France 107: 515–523.

Deuve T (2005) Description de Trechini nouveaux de Chine, de Sumatra, du Vietnam, du Népal et de l'Afrique orientale (Coleoptera, Caraboidea, Trechidae). Revue française d'Entomologie (N.S.) 27: 5–16.

Deuve T, Quéinnec E (2014) Deux nouveaux Trechini de la Chine du Sud-Ouest (Coleoptera, Caraboidea, Trechinae). Bulletin de la Société entomologique de France 119: 467–471.

Deuve T, Tian MY (2008) Deux nouveaux Trechidae cavernicoles de Chine (Coleoptera, Caraboidea). Revue française d'Entomologie (N.S.) 30: 27–32.

Deuve T, Tian MY (2009) Un nouveau Trechini cavernicole aveugle au nord du fleuve Yangtzé, dans le Hubei (Coleoptera, Caraboidea). Bulletin de la Société entomologique de France 114: 181–184.

Deuve T, Tian MY (2010) Un nouvel *Uenotrechus* cavernicole dans le Guangxi, Chine (Coleoptera, Caraboidea, Trechidae). Revue française d'Entomologie (N.S.) 32: 101–103.

Deuve T, Tian MY (2011) Nouveaux Trechini et Tachyini des cavités souterraines de Chine méridionale (Coleoptera, Caraboidea). Nouvelle Revue d'Entomologie (N.S.) 27: 99–108.

Deuve T, Tian MY (2014) Un nouveau Trechini aphénopsien dans l'ouest du Guizhou (Coleoptera, Caraboidea). Bulletin de la Société entomologique de France 119: 319–322.

Deuve T, Tian MY (2015) Trois nouveaux Trechidae troglobies anophtalmes des karsts du Guizhou et du Zhejiang, en Chine (Coleoptera, Caraboidea). Bulletin de la Société entomologique de France 102: 397–402.

Deuve T, Tian MY, Ran JC (1999) Trois Caraboidea remarquables de la réserve nationale de Maolan, dans le Guizhou méridional, Chine (Coleoptera, Carabidae et Trechidae). Revue française d'Entomologie (N.S.) 21: 131–138.

Huang SB, Tian MY (2015) New species and new record of subterranean trechine beetles (Coleoptera: Carabidae: Trechinae) from southwestern China. The Coleopterists Bulletin 49(4): 727–733. doi: 10.1649/0010-065X-69.4.727

Lin W, Tian MY (2014) Supplemental notes on the genus *Libotrechus* Uéno (Coleoptera: Carabidae: Trechinae), with description of a new species from Guangxi, southern China. The Coleopterists Bulletin 68: 429–433. doi: 10.1649/072.068.0314

Magrini P, Vanni S, Zanon D (1997) Description of a new aphaenopsoid cave trechine from southeastern China (Coleoptera Carabidae Trechinae). Redia-Giornale di Zoologia 80: 107–117.

Stoch F (Ed.) (2002) Italian Habitats: Cave and karstic phenomena. Museo Friulanodi Storia Naturale, 159 pp.

Sun FF, Tian MY (2015) First cavernicolous trechine beetle discovered in Guilin karst, northeastern Guangxi (Coleoptera, Carabidae, Trechinae). ZooKeys 545: 119–129. doi: 10.3897/zookeys.545.6111

Tian MY (2010) New records and new species of cave-dwelling trechine beetles from Mulun Nature Reserve, northern Guangxi, China (Insecta: Coleoptera: Carabidae: Trechinae). Subterranean Biology 7: 69–73.

Tian MY (2011) A new subgenus and two new species of the troglobitic genus *Dongodytes* Deuve from Guangxi, China (Coleoptera, Carabidae). Subterranean Biology 8: 57–64. doi: 10.3897/subtbiol.8.1232

Tian MY (2014) A new species of the subterranean genus *Oodinotrechus*Uéno, 1998, from northern Guangxi, China, with additions to the generic diagnosis (Coleoptera: Carabidae: Trechinae). Journal of Natural History 48: 2097–2104. doi: 10.1080/00222933.2014.908967

Tian MY, Clarke AK (2012) A new eyeless species of cave-dwelling trechine beetle from northeastern Guizhou Province, China (Insecta: Coleoptera: Carabidae: Trechinae). Cave and Karst Science 39: 66–71.

Tian MY, Huang SB (2014) *Yunotrechus diannanensis* n. gen., n. sp., the first troglobitic trechine (Coleoptera: Carabidae) from a tropical area of China. Annales de la Société entomologique de France (N.S.) 50: 295–300.

Tian MY, Huang SB (2015) Two new species of cavernicolous trechines from southern China karst (Coleoptera: Carabidae: Trechinae). Journal of Cave and Karst Studies 77(3): 152–159.

Tian MY, Huang SB, Wang XH (2015) New Cavernicolous Trechine Beetles From Eastern Guizhou Province, China (Coleoptera: Carabidae: Trechinae). Journal of Entomological Research Society 17(3): 25–37.

Tian MY, Luo XZ (2015) A new species of the highly modified hypogean genus *Giraffaphaenops* Deuve, 2002 (Coleoptera: Carabidae: Trechinae). Zootaxa 3911: 581–588. doi: 10.11646/zootaxa.3911.4.7

Tian MY, Yin HM (2013) Two new cavernicolous genera and species of Trechinae from Hunan Province, China (Coleoptera: Carabidae). Tropical Zoology 26: 154–165. doi: 10.1080/03946975.2013.869097

Tian MY, Yin HM, Huang SB (2014) Du'an Karst of Guangxi: a kingdom of the cavernicolous genus *Dongodytes* Deuve (Coleoptera, Carabidae, Trechinae). ZooKeys 454: 69–107. doi: 10.3897/zookeys.454.7269

Uéno SI (1997) A new aphaenopsoid trechine beetle (Coleoptera: Trechinae) from Yunnan, Southwest China. Journal of the Speleological Society of Japan 22: 14–23.

Uéno SI (1998) Notes on *Dongodytes* (Coleoptera, Trechinae), with description of a new species. Journal of the Speleological Society of Japan 23: 1–15.

Uéno SI (1999a) New genera and species of aphaenopsoid trechines (Coleoptera, Trechinae) from South-Central China. Elytra 27: 617–633.

Uéno SI (1999b) Two new *Shenaphaenops* (Coleoptera, Trechinae) from northeastern Guizhou, South China. Journal of the Speleological Society of Japan 24: 41–50.

Uéno SI (1999c) Occurrence of a new aphaenopsoid trechine beetle (Coleoptera, Trechinae) in southern Sichuan, southwest China. Journal of the Speleological Society of Japan 24: 31–40.

Uéno SI (2000a) Notes on *Guizhaphaenops* (Coleoptera, Trechinae), with descriptions of two new species. Elytra 28: 247–264.

Uéno SI (2000b) A new cave trechine from southwestern Hubei, with notes on the genus *Cathaiaphaenops* (Coleoptera, Trechinae). Elytra 28: 265–274.

Uéno SI (2000c) New cave trechines (Coleoptera, Trechinae) from northeastern Guizhou, South China. Journal of the Speleological Society of Japan 25: 1–38.

Uéno SI (2002) New *Sinaphaenops* (Coleoptera, Trechinae) from southern Guizhou, with notes on *Thaumastaphaenops pulcherrimus*. Elytra 30: 57–72.

Uéno SI (2003a) A new genus and species of extraordinary cave trechine (Coleoptera, Trechinae) from eastern Yunnan, Southwest China. Elytra 31: 245–252.

Uéno SI (2003b) The male of *Giraffaphaenops clarkei* (Coleoptera, Trechinae), with notes on its affinity. Journal of the Speleological Society of Japan 28: 1–11.

Uéno SI (2005a) A new genus and species of cave trechine (Coleoptera, Trechinae) from a deep pothole in northwestern Guangxi, South China. Journal of the Speleological Society of Japan 29: 1–11.

Uéno SI (2005b) A new aphaenopsoid trechine beetle (Coleoptera, Trechinae) from Shennongjia in western Hubei, Central China. Journal of the Speleological Society of Japan 29: 12–17.

Uéno SI (2005c) A remarkably specialized new cave trechine (Coleoptera, Trechinae) from northern Guangxi, South China. Elytra 33: 333–339.

Uéno SI (2006a) Two new cave trechines of the genus *Sichuanotrechus* (Coleoptera, Trechinae), with notes on its type species. Elytra 34: 257–266.

Uéno SI (2006b) Cave trechines from southwestern Guizhou, South China, with notes on some taxa of the *Guizhaphaenops* complex (Coleoptera, Trechinae). Journal of the Speleological Society of Japan 31: 1–27.

Uéno SI (2007) Two new cave trechines (Coleoptera, Trechinae) from western Zhejiang, East China. Journal of the Speleological Society of Japan 32: 9–22.

Uéno SI (2008) A new species of the trechine genus *Sichuanotrechus* (Coleoptera, Trechinae), with a new record of *Sichuanotrechus albidraconis*. Journal of the Speleological Society of Japan 33: 6–10.

Uéno SI (2009) A second species of the genus *Sinotroglodytes* (Coleoptera, Trechinae), with new records of cave trechines from the northwestern part of Hunan in central China. Journal of the Speleological Society of Japan 34: 7–14.

Uéno SI (2010) Notes on three cave trechines (Coleoptera, Trechinae) from the western part of Hubei, central China. Elytra 38: 291–295.

Uéno SI, Clarke AK (2007) Discovery of a new aphaenopsoid trechine beetle (Coleoptera, Trechinae) in northeastern Jiangxi, East China. Elytra 35: 267–278.

Uéno SI, Kishimoto T (2002) Supplement of the description of *Sinaphaenops trisetiger* (Coleoptera, Trechinae). Elytra 30: 407–409.

Uéno SI, Ran JC (1998) Notes on *Sinaphaenops* (Coleoptera, Trechinae), with descriptions of two new species. Elytra 26: 51–59.

Uéno SI, Ran JC (2002) A new genus with three new species of aphaenopsoid trechine beetles (Coleoptera, Trechinae) from western Guizhou, South China. Journal of the Speleological Society of Japan 27: 42–59.

Uéno SI, Ran JC (2004) A new *Guizhaphaenops* (Coleoptera, Trechinae) from western Guizhou, South China. Elytra 32: 15–21.

Uéno SI, Wang FX (1991) Discovery of a highly specialized cave trechine (Coleoptera, Trechinae) in Southeast China. Elytra 19: 127–135.

Vigna Taglianti A (1997) A new genus and species of troglobitic Trechinae (Coleoptera, Carabidae) from southern China. International Journal of Speleology 25: 33–41. doi: 10.5038/1827-806X.25.1.3

Waltham T (2009) The Karst Land of southern China. Geology Today 25: 232–238. doi: 10.1111/j.1365-2451.2009.00736.x

Wang S, Xie Y (Eds) (2005) China Species Red List. Vol. 3. Invertebrates. Higher Education Press, 891 pp.